GUAM AGRICULTURAL EXPERIMENT STATION,
ISLAND OF GUAM.
Under the supervision of the United States Department of Agriculture.

EXTENSION CIRCULAR No. 3.

# CORN GROWING IN GUAM FOR CLUB MEMBERS.

BY

W. J. GREEN, Superintendent of Extension.

Issued January, 1923.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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CORN is probably the most important crop grown in Guam. Together with rice it forms the principal food crop of the majority of the natives. Every small farm or ranch has its field of corn. An increase in its production will tend to lower the quantity of rice that is annually imported for food purposes. Rice land here is limited to a comparatively small acreage. Corn land, on the other hand, is found in area sufficient to feed more than the island's population if properly handled.

This circular, while written primarily for members of the boys' and girls' clubs of Guam, contains information that should be of service to anyone growing corn on the island.

# CORN GROWING IN GUAM.

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## WHERE CORN ORIGINATED.

Corn is a native of North America. It was grown by the Indians when Columbus discovered America. The early settlers in America soon learned how to grow corn and it was for them one of the principal sources of food for many years. Every boy and girl who has studied American history knows about these things.

Corn has been grown in Guam for about 250 years. It is supposed to have been brought to the island by soldiers from Mexico who were doing duty in Guam. The climatic conditions of Mexico do not differ widely from those of Guam. Although many varieties of corn have been tried by the Guam Experiment Station, none has been found so well suited to local conditions as the common white corn that has been grown and kept pure on the island since its introduction.

## CULTURAL DIRECTIONS.

### SELECTING THE PLAT.

The first thing to be considered in growing corn is the selection of a suitable plat. Corn for its best development requires a light loamy type of soil such as is usually found in valleys between the hills or near a river or other stream. A heavy clay soil is hard to work. It runs together during the rainy season and dries out and bakes during the dry season. A soil that is too sandy and that dries out too quickly does not contain enough food to feed the crop.

Corn should be grown in a well-drained, fertile, sandy loam field. As a usual thing it does not grow well on rocky hillsides or upland, and on the other hand it will not thrive on low, wet ground where water stands for any length of time. The corn plat should be located near the ranch house, so that it can be watched by some one throughout the day.

### PREPARING THE SEED BED.

After the plat has been selected the ground should be carefully prepared for planting. The ground in which the seed is planted is commonly called a seed bed. Most people in Guam do not realize the importance of having a good seed bed for corn.

Many of the farmers of the island clear their lands of weeds and grass with a fosiño and then plant the seed in the hard ground. These methods may be rewarded with a fairly good crop during some seasons, but they are not nearly so good as plowing the ground and breaking the clods into small pieces to make a well-prepared seed bed for the crop. (Pl. I, Fig. 1.)

*Reasons for plowing.*—There are four principal reasons why plowing (Pl. I, Fig. 2) benefits the land and makes a better crop: (1) Plowing turns up and pulverizes the hard ground and makes a good place for the roots to start growth in; (2) it brings loose soil to the surface where it is exposed to the action of the sun and rain. All soil contains plant food, but much of it is not in a form that can be used by the plant. In such a state this food is of no more use to the plant than is uncooked rice or other raw food to a person. The plant food in soil that is stirred and exposed to the sun and rain is changed so that it can be used by the plants in very much the same way that rice and other foods are made fit to eat by cooking; (3) plowing also improves the soil by turning under weeds, grass, and trash, which rot and enrich the soil in plant food and make it easy to work; and (4) plowing puts the soil in such condition that it will readily hold moisture during the dry season, and if the land is well drained will not hold too much in the wet season.

*Time to plow.*—Land should never be plowed when it is very wet. If plowed in that condition it will dry out in hard lumps and clods that are difficult to break.

The best time to plow for corn is about a month before planting time. Newly plowed land is very loose and contains so many air spaces that it does not give the plants as good a start as ground that has had time to pack somewhat.

*Depth to plow.*—For best results the soil should be plowed to a depth of about 8 inches. It is hardly possible to reach that depth in all soils, however, with the small one-handled plow that is pulled by a carabao, such as is used in Guam. Land that has never been plowed should not be plowed too deeply at first. The best plan is to plow about 5 inches the first season and about 1 inch deeper each time after that until the ground is broken to a depth of about 8 inches.

*Smoothing the seed bed.*—As soon as the land is plowed it should be smoothed down. This is done by breaking up all the clods and lumps to make what is called a well-pulverized seed bed. The best way to pulverize the soil is to use a harrow on it. (Pl. II, Fig. 1.) This implement is drawn by a carabao or bullock. A farmer who does not own a harrow can have one made by a blacksmith.

Some farmers use a 5 or 7 shovel cultivator to level down the ground after planting. This implement does not do the work as rapidly as a harrow does, but it is better than nothing at all. The disk harrow is a great help on the farm. It can be used to cut the weeds, stalks, etc., before the land is plowed, and then used to break up the clods and make a firm, level seed bed for planting. When the island government was operating the Barrigada farm, a disk harrow (Pl. II, Fig. 2) was used in place of a plow to break the land. This plan works very well on loose soil having a few inches below the surface cascajo or rocks that prevent plowing. It is not recommended, however, for heavier soils such as are found on the southern half of the island.

FIG. 1.—CORN GROWN BY PROPER METHODS.

FIG. 2.—PLOWING LAND FOR CORN.

FIG. 1.—USING THE HARROW.

FIG. 2.—THE DISK HARROW.

## PLANTING.

*Time of planting.*—Two crops of corn are usually grown in one year in Guam. The customary time of planting is just before and at the end of the rainy season. This season does not always begin and end at the same time, and the exact dates that are the best for planting can not be given because they vary from year to year. The best plan is to have the land ready and then plant as soon as the season seems favorable. Should the farmer happen to mistake the correct time for planting, he can replant the crop later.

*Depth of planting.*—Under ordinary conditions corn should be planted from 1 to 2 inches deep if the soil is moist. If the ground is dry, the seeds should be planted deep enough to be in moist soil. The deeper the corn is planted the longer it will take the crop to come to the surface.

Some persons think that by planting the seed over 2 inches deep they can make the roots go farther down into the ground. This is a mistake, for the permanent roots form at about the same depth no matter how deep the seed is planted.

*Distance of planting.*—Most Guam farmers plant their corn too thickly. Under ordinary conditions the rows should be made $3\frac{1}{2}$ feet apart. The seed should be planted in hills that are from 3 to $3\frac{1}{2}$ feet apart, depending upon the amount of moisture and the fertility of the soil.

In Guam all corn is planted by hand. The most successful method of planting is that of laying off the rows with a plow and dropping the kernels at the right distance apart in the rows. The kernels should be covered with dirt and the soil well firmed down after planting.

The farmer who uses a cultivator to keep his field free from weeds (and all farmers who expect to obtain the best results from their work should use a cultivator) should lay off the rows in both directions and plant the corn where the rows cross. If this method is followed, the corn can be cultivated from both directions and there will be no necessity for cleaning the grass and weeds from between the hills in each row with a fosiño.

A number of modern corn planters could be used to good advantage, but as yet none are in use on the island. Any person wishing to obtain information about these or any other farm implements should consult with some member of the experiment station staff.

*Rate of planting.*—Experiments have shown that the most corn per acre can be produced if three stalks are grown in each hill. It is always best, however, to plant four or five kernels in each hill, so that the right number will grow. The extra stalks can be thinned out later.

The kernels should not be planted too close together. They should be placed a few inches apart in order that the extra stalks may be pulled up without disturbing the remaining plants.

The station has found that 1 ganta, or 5 pounds, of common Guam corn will plant 0.31, or almost one-third, acre in hills 3 feet apart in $3\frac{1}{2}$-foot rows, if four kernels are dropped in each hill. If five kernels are used, the same amount will plant 0.29, or almost three-tenths, of an acre. Figured in terms of hectares, 1 ganta will plant 0.14 or about one-seventh hectare if 4 kernels are planted in each hill, and

0.13 or a little more than one-eighth hectare if five kernels are planted in hills 3 feet apart and in $3\frac{1}{2}$-foot rows.

At the same distance of planting, it will take 2.76 gantas or 13.8 pounds of corn to plant 1 acre, and 6.9 gantas or 34.5 pounds to plant 1 hectare, if four kernels are used. If five seeds are planted in each hill, it will take 3.43 gantas or 17.15 pounds to plant 1 acre, and 8.57 gantas or 42.85 pounds to plant 1 hectare.

By using the figures given above, one can learn how much seed he needs to plant a field of any size to corn.

### THINNING.

When the young plants are from 8 to 12 inches high they should be thinned so as to leave only three stalks in each hill. (Pl. III, Fig. 1.) In thinning plants, care should always be taken to leave the largest and healthiest stalks.

Three good plants will produce more grain than four or more plants. Too many stalks crowd each other so that none can grow as large and as strong or produce as much corn as a smaller number of stalks. (Pl. III, Fig. 2.) Extra stalks are almost as much of a nuisance as weeds, because they use up the plant food and moisture that is needed by the crop.

Many farmers on the island make the mistake of leaving too many stalks in each hill, thinking that a large number of stalks will produce a lot of corn. During the first season that the corn club was organized in Guam, one of the club members was found growing as many as 15 stalks in each hill. Another boy, who had a plat near by, had thinned his corn to the proper stand, and the first boy was told to let his corn grow so that a comparison might be made between the two plats to see which would produce the more grain. The result was that the member who let so many stalks grow in each hill had no grain at all, while the one who thinned his corn had a very good yield. This was an extreme case, but it shows that thinning greatly helps crop yields.

Tests made at the experiment station show that the highest yields are obtained from fields that have two or three stalks per hill. The same experience has been had by the most successful corn-club members of the island.

### CULTIVATING.

After a person has planted good seed in a well-prepared seed bed and has obtained the proper stand, he is likely to think that most of the work necessary to produce a good crop has been done. In this, however, he is mistaken, for unless the field is kept well cultivated it will not produce high yields.

*Reasons for cultivating.*—The principal object of cultivation is to kill weeds. A plant eats and drinks the same as does an animal, only in a different manner. Having no mouth, a plant can not chew its food, but it takes most of its food and water through its roots. Before food can be used by the plant it must be dissolved in the water in the soil and taken up in liquid form by the roots. Weeds and grass use plant food and moisture that are needed to nourish the corn, and in that way they keep the plants from growing as well as they should. Weeds also shade the young plants which

must have plenty of sunlight to develop properly. Cultivation keeps the surface soil in good condition. If the soil is well stirred it will not become hard and filled with cracks during periods of dry weather. It also helps to warm up a cold, wet soil, and to change the plant food in the soil into a form that can be used by the plants.

*Tools to use.*—Until a few years ago, practically all Guam farmers used nothing but a fosiño to cultivate their crops. (Pl. IV, Fig. 1.) Since the establishment of the experiment station, however, a number of the more progressive farmers have started to use cultivators. (Pl. IV, Fig. 2.) These are 5 or 7 shovel implements that can be pulled by a carabao or bullock. The cultivator is better than the fosiño for several reasons. In the first place it enables a man with a carabao to do as much work as 10 men can do with hand tools. The use of modern implements thus means the saving of much time and energy. In the second place, a cultivator stirs up the soil while a fosiño merely cuts off the weeds.

The harrow is another implement that can be used in cultivating corn, and it is of value only when the plants are small. If the corn has been planted so that it can be cultivated in both directions, all of the work can be done with a cultivator. If, however, it can be cultivated in one direction only, the fosiño will have to be used to clean the land of weeds and grass that grow between the plants in the rows. A hoe may be used for this purpose, but most of the farmers can do much better work with a fosiño and can do it much more quickly than they can with a hoe.

*Time to cultivate.*—Cultivation should be given as often as the weeds start. If this practice is carried out while the weeds are small, the field can be kept clean with little difficulty.

Cultivation should not be stopped until the corn begins to tassel and the ears start to develop. If a hard crust forms on the ground before the corn comes up, the field should be gone over with a harrow.

*Depth to cultivate.*—Before one can know the right depth to cultivate corn, he should know something about the manner in which the roots of the plant grow. (Pl. V, Fig. 1.) The corn plant has many small roots that do not only penetrate into the soil to considerable depth, but also spread a few inches under the surface to a great distance in each direction.

When the plants are about 18 inches high the roots have usually crossed each other in the $3\frac{1}{2}$-foot rows. In cultivating the crop, it should be borne in mind how the roots grow so that none will be cut or injured. If the roots are cut the plant will not be able to take up from the soil all the food and moisture that it needs.

The first few cultivations should be made rather deep (3 or 4 inches) with the cultivator so that the roots will penetrate into the soil. The roots will not grow in the loose soil that is stirred up by the cultivator. The later cultivations should be more shallow than the first so that none of the roots will be cut.

## HARVESTING.

*Breaking over the stalks.*—It is a practice among the Chamorro farmers to break over the corn crop (Pl. V, Fig. 2), doubling the stalks just below the ears when the crop is almost mature. This practice seems to be very good, especially during the rainy season.

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When the stalks are broken over the ears hang with the tips downward and readily shed all water. The practice prevents water from collecting under the husks, where it would cause germination or rotting of the grain. Breaking over the stalks also causes the ears to mature more quickly than they would normally. In reality it prevents the loss of the crop during the rainy season. The proper time to break over the stalks is when the kernels of the corn are just beginning to harden.

*Gathering the ears.*—The usual practice in Guam is to gather the corn as soon as the kernels are hard. It is a good practice in any climate where the corn is likely to sprout or be damaged by weevils if the crop is left in the field. In harvesting the corn, one should remove the husks from the ear in the field.

*Drying.*—As freshly harvested corn contains considerable moisture, it is shelled as soon as possible and dried on mats in the sun. (Pl. VI, Fig. 1.) At the time of shelling, which operation is performed by hand, the corn of poor quality is separated from the rest and used for stock feed. The greater part of the corn of good quality is kept for food.

The corn should be kept in the sunlight for a few days to drive away weevils as well as to dry the grain. After it is dried, the corn should immediately be stored. If it is not, it will have to be dried every week or so, especially during the rainy season.

Ear corn that is to be exhibited at a fair may be dried by hanging the ears so the sun and wind will strike them. After they are dry such ears can be saved for a reasonable length of time if they are hung in the kitchen where weevils will be kept away by the smoke.

## STORING.

In Guam, where the climate is damp, corn will spoil if it is left in open containers, especially during the rainy season. Weevils also do much damage to seed that is not stored in the proper manner and rats are very destructive to corn that is not protected from them.

### CONTAINERS.

*Metal tanks.*—Some years ago the experiment station devised a metal tank (Pl. VI, Fig. 2) which has given great satisfaction as a receptacle for storing grain. This tank is made of galvanized sheet iron and is so constructed that it can be made air-tight with little or no difficulty. It has one opening in the top into which the grain may be poured or through which it may be removed. Most of the smaller tanks have an opening that is about 8 inches in diameter while the larger ones have a proportionally larger opening. This hole is surrounded by a collar about $1\frac{3}{4}$ inches high. One inch outside this ring there is soldered another collar which is one-quarter of an inch less in height.

The opening A is closed with the lid E which has a flange that fits over the inner collar B. The tank is sealed by pouring oil into the space D between the two collars. The flange of the lid F goes down into this oil and thus makes it impossible for any moisture or insects to get into the tank. The inner collar B is higher than the outer collar C and keeps the oil from getting into the tank.

FIG. 1.—CORN AT RIGHT HEIGHT FOR THINNING.

FIG. 2.—RESULTS OF GROWING CORN WITH FROM ONE TO SIX STALKS PER HILL.

FIG. 1.—USING A FOSIÑO.

FIG. 2.—USING A CULTIVATOR.

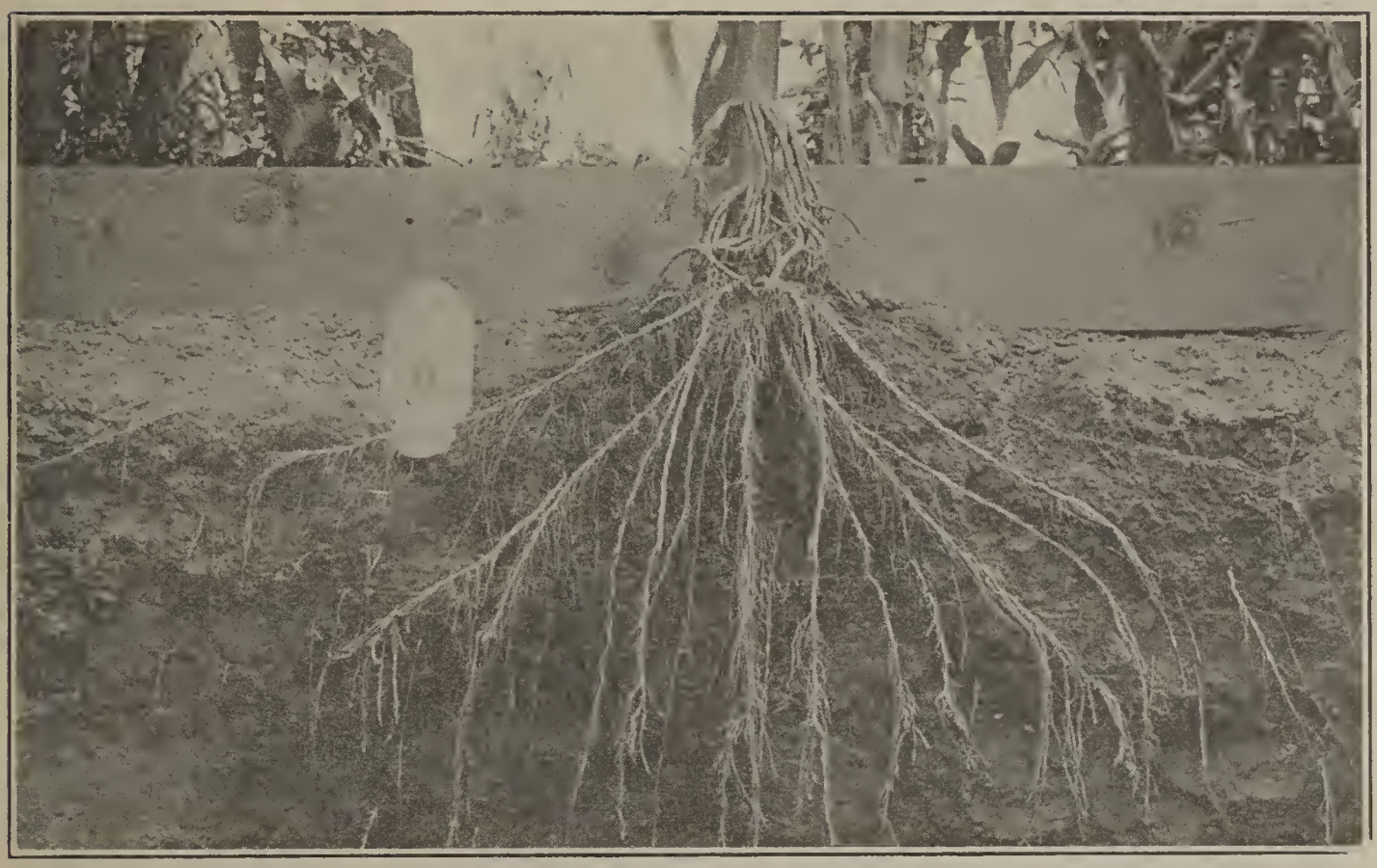


FIG. 1.—ROOT SYSTEM OF CORN PLANT AT SILKING TIME.

FIG. 2.—FIELD WITH STALKS BROKEN OVER.

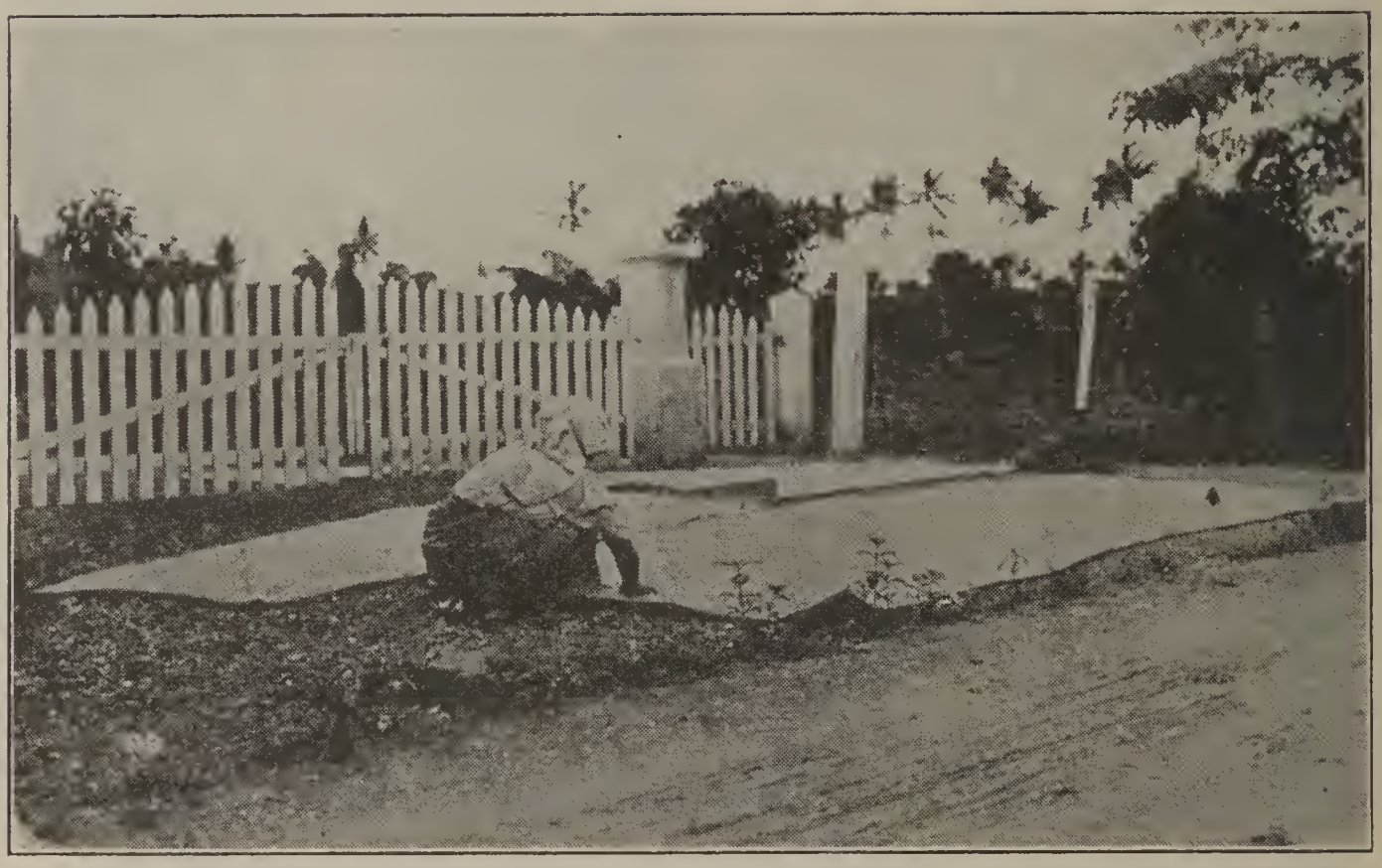


FIG. 1.—DRYING CORN ON MATS.

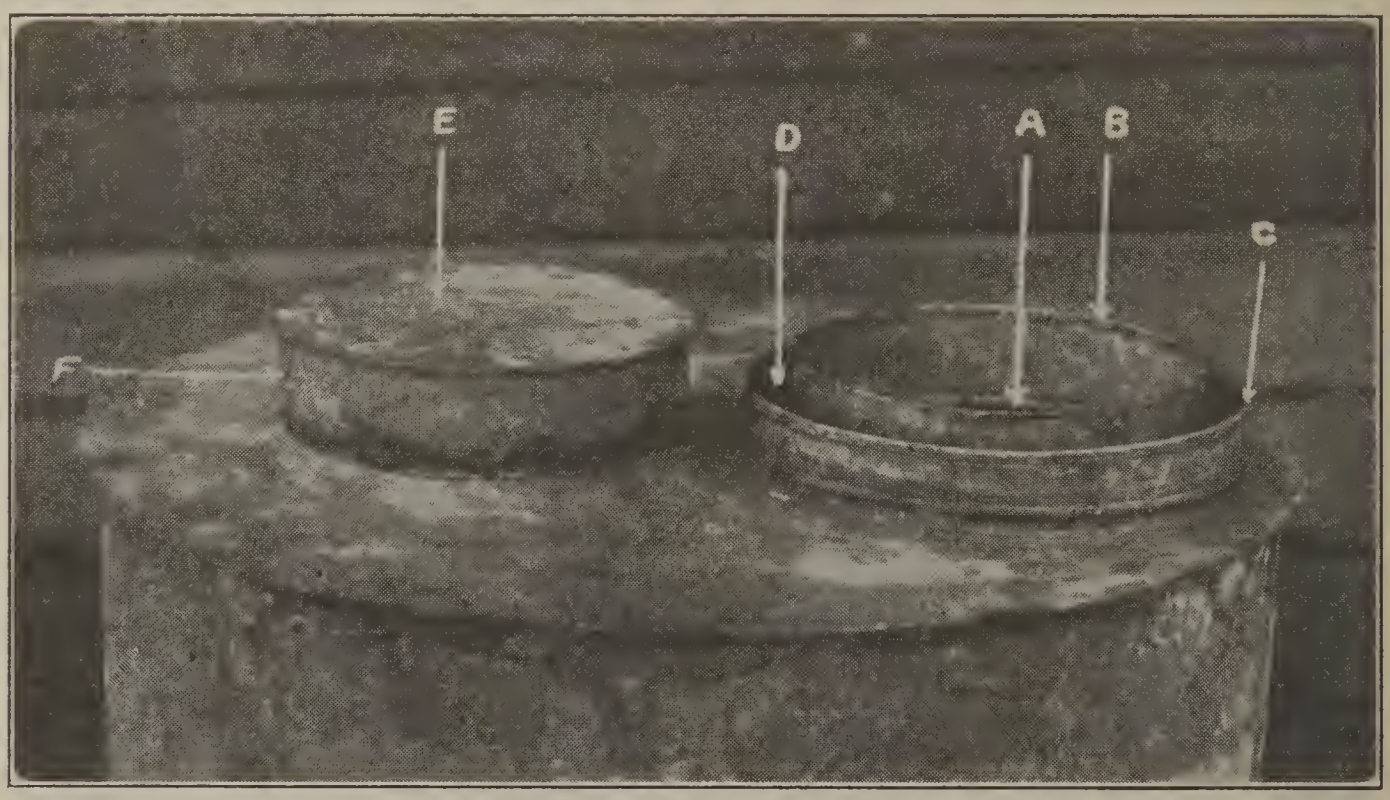



FIG. 2.—METAL STORAGE TANK.

These tanks can be made by any tinsmith and are worth many times their cost in the grain that they save. Very good storage tanks have been made on the island from old coffee drums and similar containers. They serve the purpose very well and are not as expensive as the tanks that are made from sheet metal. Care should be taken to have the flange on the lid of sufficient depth to go down into the oil in the space between the two collars because it is this feature which makes the tank a good container.

*Other containers.*—A club member who can not afford to buy one of the metal tanks can use certain other containers for small amounts of seed. Tin boxes, such as cracker tins, make good containers if the lids are kept tightly closed. These boxes are fairly plentiful on the island and can usually be obtained free of charge.

A small amount of seed may be kept in bottles that are properly stoppered. The cork should be pushed far enough down into the neck of each bottle to leave a space of at least one-fourth inch above, which is filled with coconut oil, or better still, with vaseline or some similar material.

## SELECTING SEED.

Poor seed can never produce a good crop, and if good corn is to be expected good seed must be selected for planting the next season's crop. The people of Guam have their own method of selecting seed. Just before planting time the farmer and his family go over the supply of corn on hand and pick out the largest kernels for planting. While this method of selecting seed is better than none at all, it is not the best method to use.

*Time to select seed.*—Seed corn should be selected in the field before the stalks have been broken over. Some one should go through the field and mark the best ears with a piece of string, pago, or other material. When the corn is harvested these ears should be kept separate from the others.

*Kinds of ears to select.*—In selecting the ears from the field one should (1) take the ears that are not too high from the ground—if the ears are too high the stalks are more easily blown down by high winds than they are where they grow rather low on the stalk; (2) for the same reason, ears should not be selected from tall, whip-like plants—the stalks should be fairly short and strong; (3) large, well-shaped ears should be chosen. Although a person can not tell exactly what an ear is like before it is husked, he can compare it with the other ears in the field and form some idea of its shape; and (4) seed corn should not be selected from stalks that are growing near plants having poor ears or none at all.

Before an ear can produce grain a small particle of the yellow dust from the tassel, called pollen, must fall on the end of each silk. This fact can be proved by tying a paper bag very securely over an ear just before the silk comes out, and leaving it for several weeks. It will then be found that the ear is nothing but a cob and that not a single kernel of corn has been produced.

The pollen may come from the stalk on which the ear is borne, or it may come from another stalk. For this reason an ear of corn growing near a poor plant may look good, but it may have been pollinated with some of the pollen from the poor stalk. In such a case the plants growing from this ear after it is planted may be like

the poor one from which the pollen came, and not like the good one on which the ear was borne.

*Number of ears to select.*—About three times as many ears as are needed for seed should be selected in the field. After these ears are harvested they should be picked over very carefully and the best ones saved for mother ears. In making this final selection one should follow the directions given on the score card.

## PREPARING EXHIBITS.

Every club member is supposed to make an exhibit of his corn at his district fair or club contest and at the Guam Industrial Fair. (Pl. VII.) He should take great care in selecting and preparing his exhibits because they are a means of showing the people of the island what he is doing in his work.

*Score card for ear corn.*—At the fairs each sample of corn is scored according to a certain scale of points. Only samples that come nearest to filling the requirements given on the score card should be exhibited. The following score card gives the scale of points in judging ear corn:

### SCORE CARD FOR EAR CORN.

| Requisites for good ear corn. | Possible score. | Score given. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| Uniformity of exhibit (all ears should be of the same size, shape, and color, and have the same number of grain rows) | 15 | |
| Length of ears (should not be less than 6½ inches) | 10 | |
| Circumference of ears (at a point three-quarters the distance from the tip to the butt, the ear should not be bigger around than it is long) | 10 | |
| Shape of ears (should not taper too much from the butt to the tip) | 5 | |
| Butts and tips (should be well filled with unbroken rows extending to end) | 5 | |
| Kernels (should be of the same size and shape, and fairly deep) | 10 | |
| Space between rows (rows should be close together) | 5 | |
| Color (all ears should be of the same color; kernels should be one color) | 10 | |
| Seed condition (mature, sound, free from insect injury, mold, or rot, and of strong vitality—large germs, no dead kernels) | 20 | |
| Proportion of corn to cob (cob should not be too large for size of ear; kernels should be deep and close together) | 10 | |

### Explanation of Score Card for Ear Corn.

*Uniformity of exhibit.*—Ten ears are required for an exhibit at all fairs in Guam. Care should be taken to have the exact number—no more or no less. All ears in the sample should be of the same size, shape, and color, and should have the same number of grain rows.

*Length of ears.*—The common Guam corn has a short ear compared with that of most of the varieties grown in the States. A good ear for exhibit should not be less than 6½ inches long.

*Circumference of ears.*—By circumference is meant the distance around the ear. It is usually measured at a point three-fourths the distance from the tip to the butt. At this point the circumference should not be larger than the ear is long.

*Shape of ears.*—The ear of corn should not taper too much from the butt to the tip. Most Guam corn is very good in this respect.

*Butts and tips of ears.*—The butts and tips should be well filled with grain. The rows should extend well to the end of the cob. Do

not cut off the cob to make the tip better looking, because the judge will count off as much for an ear that has had the tip trimmed as he will for the very worst protruding cob.

*Kernels.*—The kernels on all the ears in the sample should be as nearly alike as possible in size and shape. They should be fairly deep, because deep kernels mean more grain to the ear. The average kernel of Guam corn is a little less than one-half inch in depth and slightly larger in width. The kernels should be firm on the cob and well filled.

*Space between rows.*—The space between the grain rows should not be too large. A large space means that the ear will have less grain. On the other hand, the rows should not be too close together, because in Guam the corn will not dry out well unless there is some space between the rows.

*Color.*—The common Guam corn is white, but in some districts yellow, red, and blue corn grows. All the ears in each sample should be of the same color. Not only should all the ears be alike, but all the kernels on each ear should be of the same color.

*Seed condition.*—This point is the most important one on the score card, for although a sample may be good in other points it will be of no value for seed unless it will grow well.

The only way to learn whether a certain ear of corn will grow is to test it, as explained later in this circular. There are, however, certain points that indicate to a large extent whether or not a sample will make good seed.

The ears should be mature. If the corn has not fully ripened, the kernels may sprout. The corn should be sound; that is, it should not be moldy, rotten, or damaged by insects or disease. It should be of strong vitality. The germ or heart of the kernel should be large and there should be no dead kernels on the ear.

*Proportion of corn to cob.*—The cob should not be too large for the size of the ear. A very large ear of corn, on account of having too large a cob, may contain less grain than a smaller ear. The kernels should also be deep and fairly close together.

### EXHIBITING SHELLED CORN.

Most of the corn in Guam is shelled as soon as it is harvested in order that it may dry as rapidly as possible. It is in this form mainly that corn is bought and sold or kept for home use.

At the Guam Industrial Fair either one-half or 1 ganta of shelled corn is required for exhibit. Care should be taken to show the exact amount called for in the premium list. The score card for shelled corn is as follows:

### SCORE CARD FOR SHELLED CORN.

| Requisites for shelled corn. | Possible score. | Score given. |
|---|---|---|
| | *Per cent.* | *Per cent.* |
| Uniformity (all grain should be of the same size, shape, and color) | 20 | |
| Size and shape of kernels (large, plump, fairly deep) | 20 | |
| Market condition (dry, clean, free from dirt, trash, etc., and not moldy or rotten) | 30 | |
| Seed condition (mature; not broken, sprouted, dead, or damaged by insects or disease) | 30 | |

### Explanation of Score Card for Shelled Corn.

*Uniformity.*—The kernels should be, as nearly as possible, all of the same size, shape, and color. Mixed grain makes a poor exhibit.

*Size and shape of kernels.*—The kernels should be large and plump, about half an inch in depth and somewhat larger in width.

*Market condition.*—This means the value on the market of the sample for human food. The corn should be dry, otherwise it will not keep well. It should not contain any moldy or rotten grain, because such kernels lower the market value and make the corn unfit for food. The corn should be free from dirt, trash, or other material that may be mixed with it.

*Seed condition.*—In order to grow well, the corn should be mature and contain no broken kernels. The sample should have no dead or sprouted grain, or any that has been damaged by insects or disease. All such corn makes poor seed.

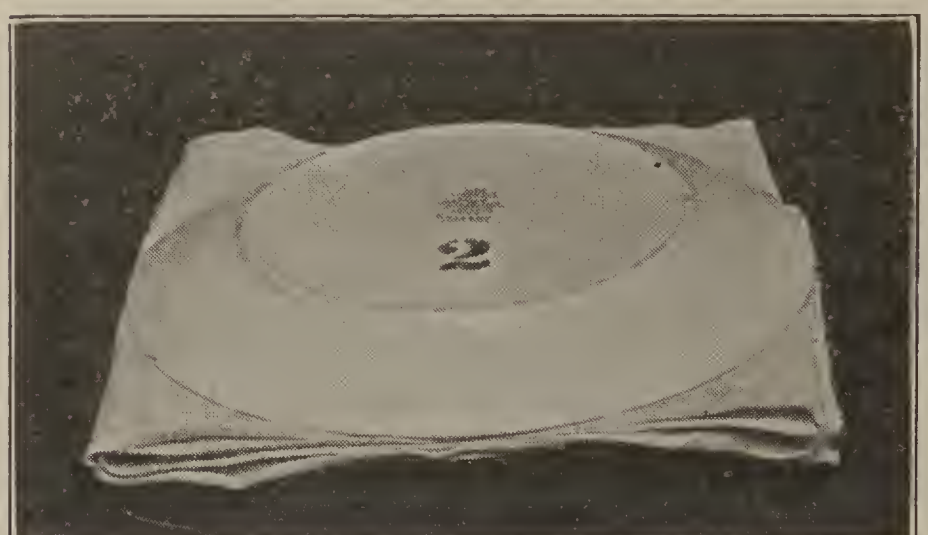


Fig. 1.—The plate tester.

## TESTING SEED.

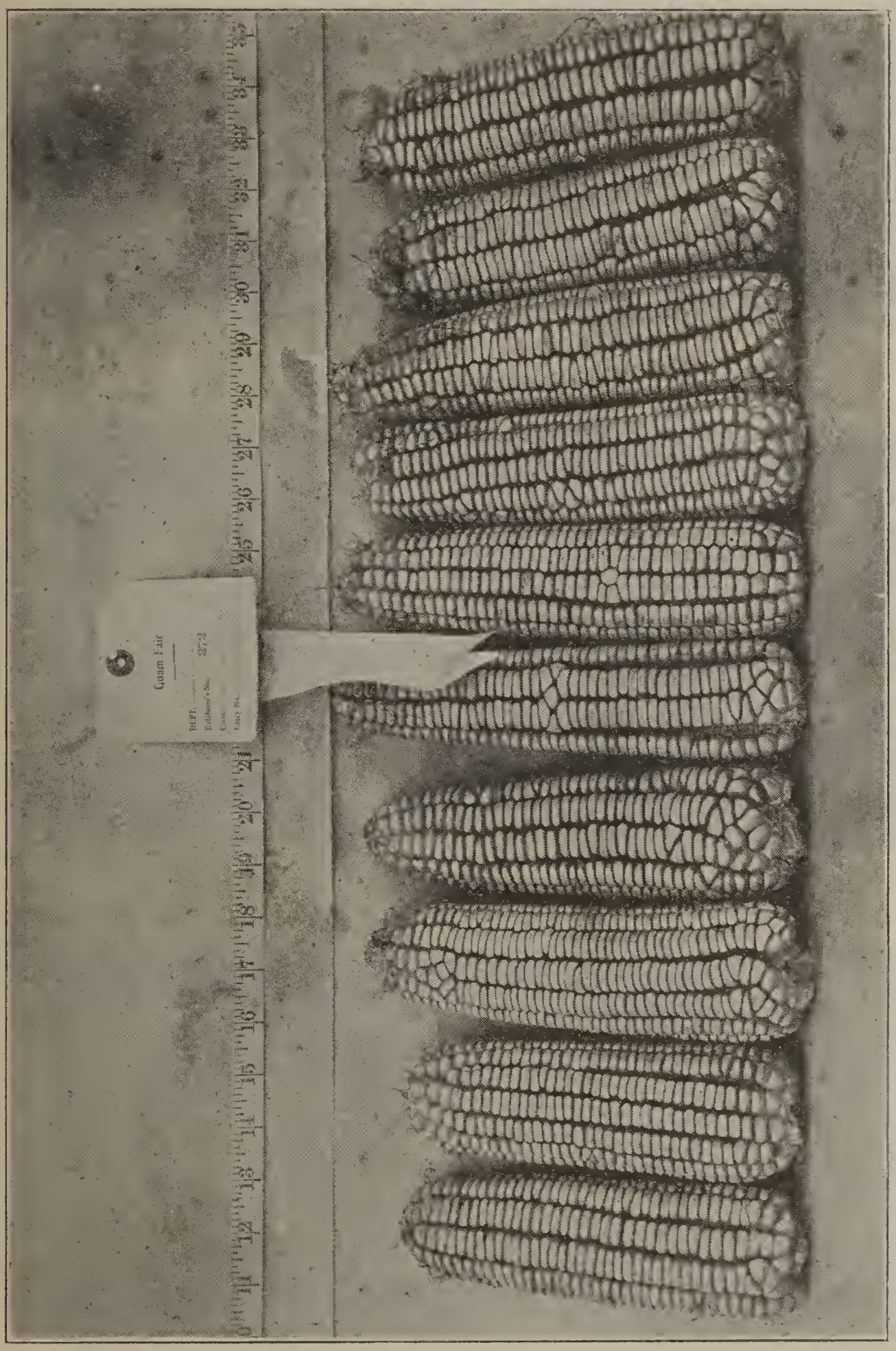
Even when it is given the best of care, some corn will not grow well. The seed of such corn should not be planted. It is a waste of time and money to use it. Since one can not always tell by looking at it whether the seed will grow, he must test it. Testing seed is not a difficult matter at all. Even the small school children can do it.

### THE PLATE TESTER.

A good method of testing shelled corn is to use what is called the plate tester. (Fig. 1.)

*Making the test.*—After thoroughly mixing the seed, take out 100 kernels just as they come—good, bad, large, or small—to represent all the seed in the lot. A sheet of paper (newspaper will do) should be folded several times and placed in a plate or shallow pan. Blotting paper is still better if it can be had. After the paper is placed on the plate it should be moistened. The 100 kernels of corn are then placed on the paper and covered with several thicknesses of other paper, which are also moistened. Another plate or shallow pan is then placed over the paper to keep it from drying out too quickly.

*Reading the test.*—The paper should be moistened every night and morning for seven days. At the end of that time the top plate and paper should be removed. A person can then see how many of the kernels have sprouted. If all of them have started to grow, all of the corn will very likely grow when it is planted in the field. If, on the other hand, only half of the grains have sprouted, the corn should not be used for seed. If, however, as sometimes happens, there is




PRIZE CORN AT 1921 GUAM INDUSTRIAL FAIR.

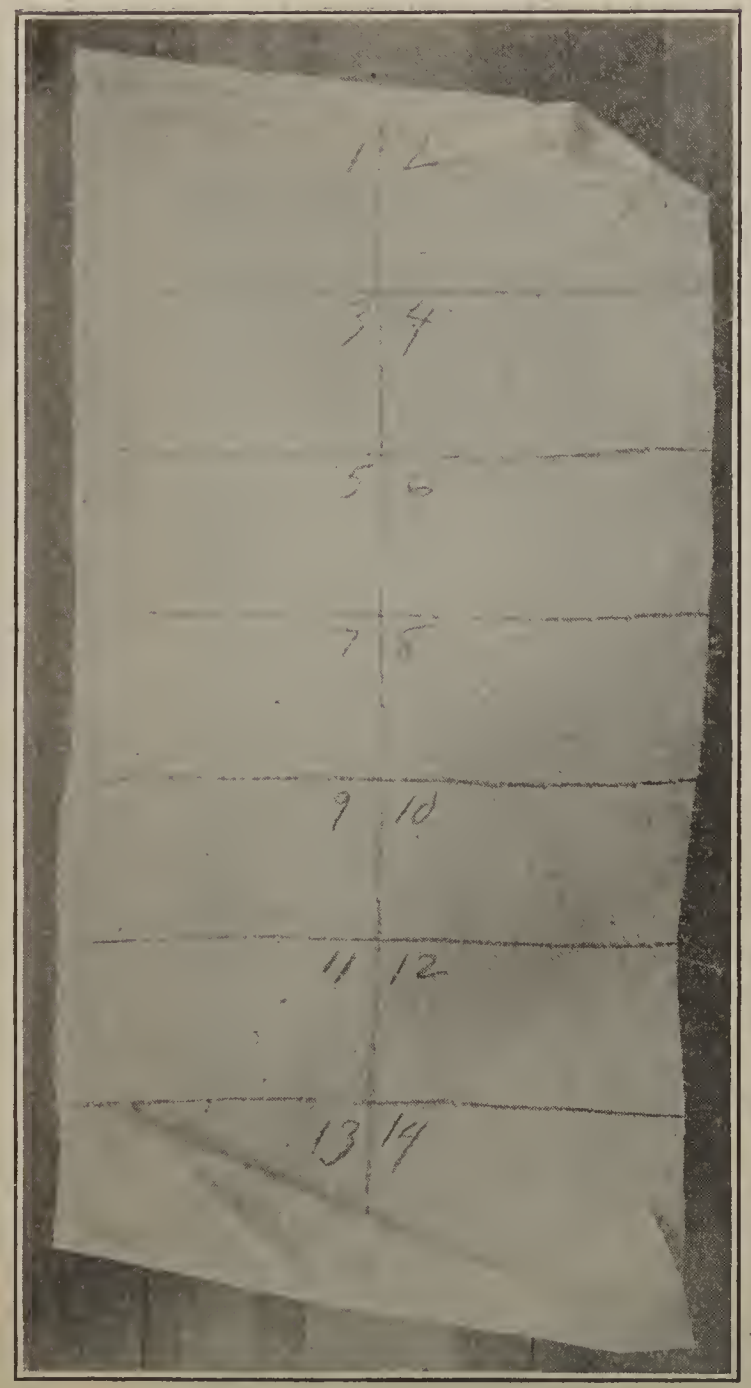



FIG. 1.—CLOTH MARKED OFF, READY FOR KERNELS.

FIG. 2.—KERNELS IN PLACE, ONE FLAP FOLDED.

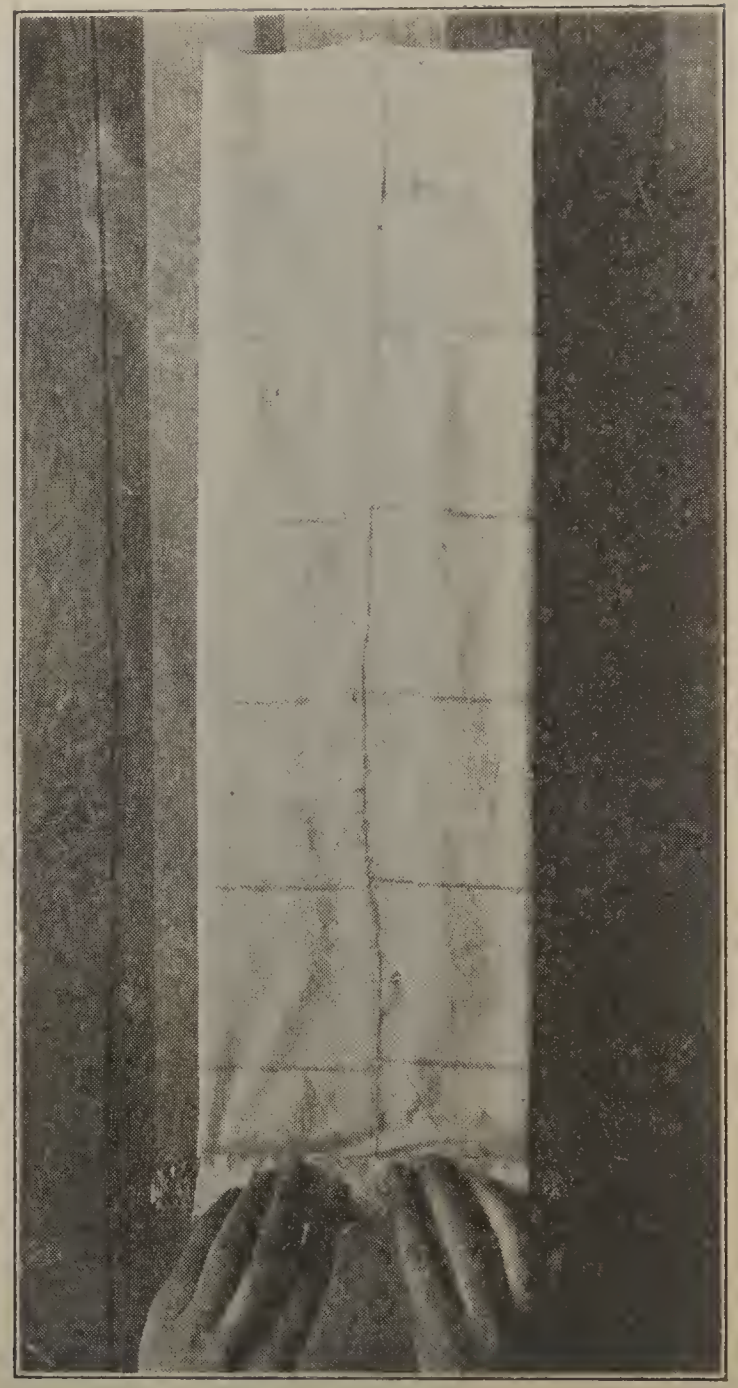


FIG. 3.—ROLLING THE RAG DOLL.

THE RAG DOLL TESTER.

no other seed to be had, just twice as many kernels should be planted in each hill as there would be of good corn.

### THE SAND-BOX TESTER.

The best way to test corn is to take the kernels to be tested directly from the ear. Each ear that is not good for seed can be used for some other purpose. The easiest method of testing ear corn in Guam is by using a sand-box tester.

*Constructing the tester.*—A sand-box tester (Fig. 2) is made by taking a shallow box and filling it with clean sand. Sand is better than dirt for the purpose. The box should be filled to a level with the top. An easy way to do this is to put in more sand than is needed and then scrape it off with a straight stick. The sand should be moistened by pouring water on it. It should then be marked off into squares. One of the best ways to make the squares is to drive small nails or tacks on the sides and ends of the box near the top. These

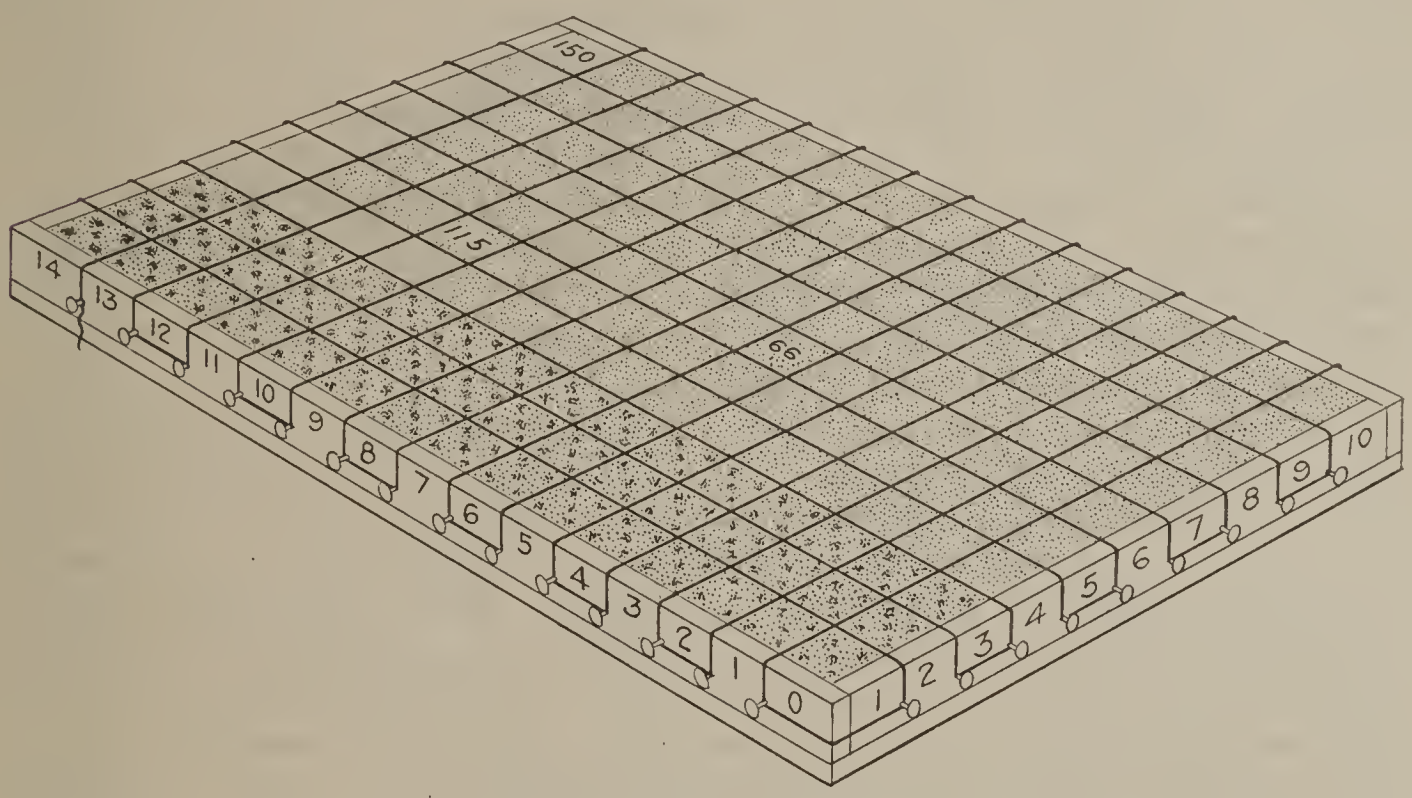



FIG. 2.—The sand-box tester.

tacks should be 2 inches apart. A string or piece of fiber such as pago can be strung from each tack to the one on the opposite side. The squares should be numbered by marking figures along one side of the box and letters along the other. Each square will then be called by the number and letter of the row in which it is located. For instance, a square in row A and row 3 would be called A–3, while one in rows D and 10 would be D–10.

*Making the test.*—The ears of corn to be tested should bear the same number that the squares have. A good way to number any ear is to write the number (A–1, etc.) on a piece of cardboard or heavy paper and fasten it to the butt of the ear by pushing a nail or large pin into the cob. Six kernels of corn should be taken from each ear of corn, two near the butt, two near the middle, and two near the tip. No two should come from the same grain row. The kernels should be removed by prying up from the sides with a dull knife so that the germ will not be injured. The six grains from each ear should be planted in the square having the same number as the ear.

The kernels should be placed tip downward about 1 inch below the surface. The sand should be kept moist until the seeds have sprouted and the young corn plants are about 2 inches high.

*Reading the test.*—After the plants are about 2 inches high, the test should be examined. If one square has only four plants growing in it, the ear from which the kernels came should not be used for seed. Perhaps the squares may have six plants, some of which are weak and sickly looking instead of being strong and healthy. This ear will not make good seed and should not be used for seed. Shelled corn can be tested in a manner similar to that described under the plate test, placing the 100 seeds in a box that has been filled with sand.

### THE RAG-DOLL TESTER.

With some white cloth one can easily make a rag-doll tester.

*Constructing the tester.*—Take a piece of fairly heavy white cloth about 16 inches wide and 3 feet long and draw a line with a pencil down the center of it. Leave a space of about 6 inches at each end, and mark off the remainder with lines drawn crosswise every 4 inches. These lines will form sections which should be numbered. (Pl. VIII, Fig. 1.)

*Making the test.*—The ears to be tested should bear the same number that the sections bear. Six kernels should be taken from each ear, as already described, and placed in the section bearing the number of the ear from which they are taken. The cloth should be moistened before the grain is placed upon it. After all the sections are filled, each side of the cloth should be folded over so that the edges will meet in the center. (Pl. VIII, Fig. 2.) The tester should then be rolled up, the folded cloth being caught at one end and rolled on a corncob or stick. (Pl. VIII, Fig. 3.) None of the kernels should be moved while the cloth is being rolled. After the cloth is rolled it should be tied in the center with a string or piece of fiber. Looking then somewhat like a rag doll, the tester is called the rag-doll tester. It should be soaked in warm (not hot) water for about three hours and allowed to drain and then wrapped in an old sack or cloth, so that it will not dry out.

*Reading the test.*—At the end of five days the tester may be carefully unfolded and the number of sprouted kernels in each section counted. This test should be read in the same manner as the sand-box test is read. Ears on which the seeds do not grow, or if they do grow out weak-looking sprouts, should not be saved for seed. The cloth used in making this tester should be boiled before it is used again, so as to prevent mold.

## INSECT PESTS.

*The European corn borer.*—Every year there can be seen in almost any cornfield in Guam, about tasseling time, stalks of corn on which the tassels are broken over. A close inspection will show a mass of frass, or sawdust-like material, protruding from holes in the stalk near the base of the tassel. When the stalk is opened a larva will be found tunneling inside. This larva, called a worm by the Chamorros, is the European corn borer and does hundreds of dollars' worth of damage every year to the corn crop in Guam. Before a person can

bring the pest under control he should know something about its habits and manner of living. The parents of the corn borer are small moths. The mother parent lays her eggs on the under side of the corn leaves. These eggs soon hatch out into small larvæ, which feed for a time on the leaves and then burrow into the stalk. They continue to grow and to feed on the corn plant, dig large tunnels or holes in the stalks, and cause the plant to weaken so much that it can not bear large ears. Sometimes as many as a hundred of the borers can be found in one plant. After a time the borer spins a web in its tunnel and turns into a reddish, lifeless-looking object called a pupa. In this stage it can not eat and can not move about. In about two weeks the pupa changes into a moth, which is called the adult corn borer. After a few days the moth begins to lay eggs, which hatch into other larvæ. Each moth lays about 350 eggs. Thus it can be seen that the borers can increase very rapidly.

Although they do the most damage to corn, these borers also attack grain sorghums, string beans, beets, spinach, tomatoes, turnips, and some kinds of grasses and weeds. The borers live from one crop season to another in the old cornstalks. For this reason the stalks should be burned as soon as they become dry enough. The roots of the stalk should be pulled up and burned also, because the pest lives in the part of the stalk nearest the roots. Every farmer in the district should burn his stalks, so that the borers will not go from one field to another, and all dry grass near the field should be burned. The cobs should be burned also. These are the best means of getting rid of the pest.

*The leaf folder.*—Sometimes a person can go through a field of young corn and find that many of the plants have their leaves folded together or rolled up. Upon looking closely at these leaves he will find that they are fastened together with a material looking somewhat like a spider web. On opening up one of the leaves that has been folded together, he will find a small larva inside. This larva is called the leaf folder because of the manner in which it folds the leaves of the corn together. It does considerable damage to young corn at certain seasons of the year. The best way to fight this insect is to go through the field and kill the larvæ by hand. This can easily be done by running the hand up each leaf that is folded over.

*The grain weevil.*—Much grain is destroyed in Guam by the grain weevil, a small black insect having a long snout. This weevil makes a hole in the grain in which it lays its eggs. These hatch out into small larvæ which feed on the inside of the kernel. The mature weevil or adult also destroys grain by eating it. The cheapest way to fight these insects in Guam is to place the grain in the bright sunlight, so that the heat will drive out and kill the old weevils and larvæ. After the weevils are driven away the grain should be stored.